WATERFRONT CONSTRUCTION

CHAPTER 16

TYPES

Waterfront construction includes pile driving, pile bracing, pile capping, pier framing, installation of deck hardware, and pile extraction.

EQUIPMENT SELECTION

The type of driving and extracting equipment used can have a considerable effect on the time required for this work. A steam, diesel, or drop hammer may be used to drive piling. A steam or air extractor or a pulling beam with blocks and cables may be used for pile extraction. The equipment used affects the time required for a given unit of work. The estimator should know what equipment is to be used.

PILE-DRIVING WORK

The task of pile driving includes assembling leads and hammer, preparing equipment for driving, sharpening pile tips, installing steel tips on wood piles, squaring and trimming pile butts, cutting holes in steel piles to facilitate handling, moving driver into place, placing pile-in leads, driving pile, and cutting pile to the required grade.

PILE-BRACING INSTALLATION

The installation of pile bracing includes cutting, drilling, handling into place, and fastening.

PILE-CAPPING WORK

Wood or steel pile capping includes cutting, drilling, handling into place, and fastening. Concrete pile capping includes forming, reinforcing, placing and curing concrete, and stripping forms.

SHEET-PILING INSTALLATION

The installation of sheet piling includes preparation of leads and equipment for driving, preparation of pile for driving, placing pile-in leads, driving pile, cutting and bracing pile, and installing deadman and tiebacks.

PIER-FRAMING INSTALLATION

The installation of pier framing includes the cutting, drilling, handling, and fastening of stringers, bridging, all decking, rails, and bumpers.

DECK HARDWARE INSTALLATION

The installation of deck hardware includes required drilling, handling, and fastening of bits, bollards, chocks, cleats, and pad eyes.

PILE EXTRACTION

The task of pile extraction includes rigging the equipment and extracting and handling piling. It also includes cutting piles below water level and carrying pieces to stockpiles.

ESTIMATING TABLES

Tables 16-1 through 16-8, pages 16-3 through 16-6, may be used in preparing detailed man-hour estimates for waterfront construction. The tables do not include delivery of materials to the jobsite.

EXAMPLE OF TABLE USE

The example below illustrates the use of Tables 16-1 through 16-8 for making a man-hour estimate for waterfront construction.

Problem. A pier to be enlarged will required 200 50-foot wood-bearing piles. Because the pier is located between several buildings, the piles cannot be prepared adjacent to the pile-driving area. In this case, increase the time for placing and driving by 15 percent because an additional crane will be needed to transport the prepared piles to the driving area (see note on Table 16-1). Work requirements are as follows:

200 — 50-foot wood-bearing piles
400 — horizontal pile braces
800 — diagonal pile braces
640 — linear feet of wood pile caps
800 — linear feet of stringers
2,500 — square feet of decking
2,500 — square feet of wearing surface
350 — feet of bull rail
10 — cleats

Solution.

Description	Units	Man-hours/unit	Subtotal
Preparing piles	200.00	2.0	400
Driving piles	200.00	1.7	340
Rigging equipment	4.00	6.0	24
Cutting pile at level	200.00	0.2	40
Dismantling equipment	4.00	6.0	24
Horizontal braces	400.00	1.0	400
Diagonal braces	800.00	0.8	640
Pile caps	0.64	100.0	64
Stringers	2.40	40.0	96
Decking	2.50	20.0	50
Wearing surface	2.50	16.0	40
Bull rail	0.35	60.0	21
Bumpers	0.02	36.0	1
Cleats	10.00	2.0	20
		Total man-hours	2,160

Table 16-1. Pile driving—wood-bearing piles

Work element description	Unit	Man-hours/unit
25-foot pile	ea	
Preparation		1.5
Drive		0.5[1]
50-foot pile	ea	
Preparation		2.0
Drive		1.5[1]
75-foot pile	ea	
Preparation		2.5
Drive		3.0[1]
Rigging leads and hammer (2-3 workers)	ea	6.0
Cut pile at required level	ea	0.2
Dismantle leads and hammer	ea	6.0
Lash piles to form dolphin	ea	1.5

NOTE: Typical crew: 1 leader and 6 workers; 10 men when placing dolphins.

[1]If an additional crane is required to support construction, increase figures by 15 percent.

Table 16-2. Pile driving—steel-bearing piles

Work element description	Unit	Man-hours/unit
25-foot pile	ea	
Preparation		1.5
Drive		0.8[1]
50-foot pile	ea	
Preparation		2.0
Drive		2.3[1]
75-foot pile	ea	
Preparation		2.5
Drive		4.5[1]
Rigging leads and hammer (2-3 workers)	ea	6.0
Cut pile at required level	ea	0.3
Dismantle leads and hammer	ea	6.0

NOTE: Typical crew: 1 leader and 6 workers.

[1]If an additional crane is required to support construction, increase figures by 15 percent.

Table 16-3. Pile driving—precast concrete bearing piles

Work element description	Unit	Man-hours/unit
20-foot pile, complete	ea	0.5
40-foot pile, complete	ea	1.5
60-foot pile, complete	ea	2.5
80-foot pile, complete	ea	3.5
100-foot pile, complete	ea	5.0

NOTE: Typical crew: 1 leader and 8 workers.

Table 16-4. Pile bracing and capping

Work element description	Unit	Man-hours/unit
Bracing[1]	ea	
Horizontal		1.0
Diagonal		0.8
Capping	1,000 lin ft	
Wood		100.0
Steel		150.0
Concrete		200.0

NOTE: Typical crew: 1 leader and 6 workers.

[1]Table based on 4-inch x 10-inch x 4-foot bracing members.

Table 16-5. Sheet piling

Work element description	Unit	Man-hours/unit
Wood (20 feet deep)	1,000 sq ft	
Preparation		4.0
Drive		35.0
Bracing		20.0
Cutting		1.5
Steel (30 feet deep)	1,000 sq ft	
Preparation		6.0
Drive		50.0
Bracing		30.0
Cutting		2.0
Concrete (30 feet deep)	1,000 sq ft	
Preparation		35.0
Drive		75.0
Bracing		30.0
Cutting		4.0
Install deadman and tieback	ea	24.0

NOTE: Typical crew: 1 leader and 6 workers.

Table 16-6. Pier framing

Work element description	Unit	Man-hours/unit
Stringers	1,000-bd-ft measure	40
Bridging	1,000 lin ft	40
4-inch deck	1,000 sq ft	20
2-inch wearing surface	1,000 sq ft	16
Bull rail	1,000 lin ft	60
Bumper	1,000 lin ft	36

NOTE: Typical crew: 1 leader and 10 workers.

Table 16-7. Deck hardware

Work element description	Unit	Man-hours/unit
Bits	ea	3
Bollards	ea	4
Chocks	ea	3
Cleats	ea	2
Pad eyes	ea	1

NOTE: Typical crew: 1 leader and 4 workers.

Table 16-8. Pile extraction

Work element description	Unit	Man-hours/unit
Pile removal		
Piles with extractor	ea	1.5
Sheet piling with extractor	1,000 sq ft	25.0
Sheet piling with crane	1,000 sq ft	20.0
Cut pile below water level	ea	1.0
Pile disposal	ea	0.5

NOTE: Typical crew: 1 leader and 4 workers.